Chapter 1
INTRODUCTION

This report documents the methods and technical criteria used by staff of the South Florida Water Management District (SFWMD or District) to develop proposed Minimum Flows and Levels (MFLs) for Lake Okeechobee, the remaining Everglades, and the Biscayne aquifer. The remaining Everglades include the Water Conservation Areas (WCAs), the Holey Land and Rotenberger wildlife management areas (WMAs), and the freshwater regions of Everglades National Park. The District is also proceeding with efforts to develop MFLs for associated areas, such as the Caloosahatchee River Estuary, by 2000, the Loxahatchee and St. Lucie estuaries by 2001, Florida Bay by 2005, and Biscayne Bay by 2004 (FDEP, 1998).

The *District Water Management Plan* (*DWMP*) *for the SFWMD* (SFWMD, 2000) includes a schedule for establishing MFLs for priority water bodies within the District. Chapter 373.042(2) requires the water management districts to annually review this list and schedule and make any necessary revisions. The SFWMD submitted a revised priority list and schedule to the Florida Department of Environmental Protection (FDEP) in November, 1999. This list indicated that MFLs were to be established by 2000 for the following priority areas: Lake Okeechobee, the Everglades, and the Biscayne aquifer in southeastern Florida and the Caloosahatchee River and Estuary and the aquifer system in southwest Florida. The District also indicated that voluntary peer review would be conducted, pursuant to Section 373.04(4) Florida Statutes (F.S.)

As a first formal step to meet the deadlines to establish MFLs for Lake Okeechobee, the Everglades, and the Biscayne aquifer, this report includes the following:

- A framework for determining MFLs based on the best available information (this approach may be applied to other surface and ground waters within the District).
- Development of a technical basis for establishing MFLs for Lake Okeechobee, the WCAs, Holey Land and Rotenberger WMAs, Everglades National Park, and the Biscayne aquifer.

Restoration goals for the Everglades were established by the Central and Southern Florida Project Comprehensive Review Study (Restudy), which has been developed by the U.S. Army Corps of Engineers (USACE), SFWMD, other agencies and interested parties, at the same time that these MFL criteria were developed. The recommendations made within the Restudy are being refined and implemented in the Comprehensive Everglades Restoration Plan (CERP). A potential for conflict exists in some areas between water levels that are established to achieve restoration and the water levels proposed in this document that are designed to prevent significant harm. As restoration goals for particular areas change over time, proposed MFLs for those areas will also be adjusted if necessary to ensure consistency.

LEGAL BACKGROUND

The Florida Legislature has mandated that all water management districts establish MFLs for surface waters and aquifers within their jurisdiction. Section 373.042 (1), F.S., defines the minimum level as the "...level of ground water in an aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources of the area..." The SFWMD is directed to use the best available information in establishing a minimum flow or minimum level (Section 373.042, F.S.). Each water management district must also consider, the protection of nonconsumptive uses in the establishment of MFLs. Providing protection for nonconsumptive uses is left to the discretion of the water management district.

Passage of the MFLs legislation in 1997 (CS/HB 715, 1249, 321, and 1339 as codified in Section 373.0421, F.S.) added the following requirements to the MFLs statute:

- When establishing a minimum flow or level, the District shall consider changes and structural alterations to watersheds, surface waters, and aquifers and the effect such constraints or alterations have had on the hydrology of the area. Such considerations shall not allow significant harm caused by withdrawals.
- The legislature also recognized that certain water bodies no longer serve their historic hydrologic functions, and that recovery of these areas may not be economically or technically feasible, and could cause adverse environmental or hydrologic impacts. Accordingly, water management districts may determine that setting a minimum flow or level for such a water body based on its historical condition is not appropriate. This exclusion does not apply to the Everglades Protection Area.
- If the existing flow or water level is expected to fall below the established MFL criteria, the District is required to develop and implement a prevention and recovery strategy for those water bodies that are expected to exceed the proposed criteria.

PROCESS FOR ESTABLISHMENT OF MINIMUM FLOWS AND LEVELS

Process Steps and Activities

The process for establishing minimum levels for Lake Okeechobee, the WCAs, the Holey Land and Rotenberger WMAs, Everglades National Park, and the Biscayne aquifer can be summarized as follows:

1. An initial draft of the MFL technical criteria document was completed in 1997.

2. A technical workshop was conducted to review this initial draft. The 1997 draft was revised to incorporate comments received from the public and various agencies and a revised the draft was released in July 1998.
3. The District Governing Board gave approval for District staff to conduct voluntary independent scientific peer review of the revised *MFL Technical Criteria* document. District staff responded to the comments provided by the review panel and have incorporated suggested revisions into this final document.
4. Development of a *MFL recovery and prevention strategy for the Biscayne aquifer, Everglades National Park, the WCAs, the Holey Land and Rotenberger WMAs, and Lake Okeechobee* is under way and will be included in the *LEC Regional Water Supply Plan*.
5. As part of the development of the recovery and prevention strategy, appropriate technical analyses are also being conducted to determine the water supply implications of the proposed MFL technical criteria on urban and agricultural users. These results will be integrated into the analysis in the final *LEC Regional Water Supply Plan* with appropriate implementation measures developed consistent with Section 373.0421 Florida Statutes.
6. In conjunction with completion of the *LEC Regional Water Supply Plan* and the *MFL Recovery and Prevention Strategy*, the District will initiate rule development.
7. Field monitoring and laboratory research programs have been initiated, or are currently being developed, to evaluate effects of implementing the MFL technical criteria proposed as part of this plan. These include both short-term and long-term projects to evaluate the effects of the proposed criteria at scales ranging from laboratory studies to field-scale monitoring projects.

Scientific Peer Review

After the Governing Board authorized District staff to conduct a peer review, the District coordinated the review under Section 373.042, F.S. That section requires an independent scientific peer review [Section 373.019, (9)] of the technical development of MFLs, stating the following:

> Independent scientific peer review means the review of scientific data, theories and methodologies by a panel of independent, recognized experts in the fields of hydrology, hydrogeology, limnology, and other scientific disciplines relevant to the matters being reviewed under Section 373.042.

The document was peer reviewed during July, August, and September 1999. In review of MFLs, the panel acted as a concurrent, interactive group of experts. In essence, the panel's task was to determine if the appropriate scientific models and applications were

employed, if all relevant data were used, and if the MFL criteria were a logical consequence of the science and the data. The panel and District staff participated in open public meetings during August and September, 1998.

Once the final data, methods, and models (including all scientific and technical assumptions employed in each model upon which a minimum flow or level is based) have undergone peer review, no additional peer review under the statute will be required. The final report is to be given significant weight when establishing MFLs.

The final report of the peer review panel was completed on September 22, 1998. Overall, the panel found the draft report to be well written, scientifically sound, and adequately referenced. The report made a clear connection between policy foundations and the technical issues. Particularly, the report made clear the issues of significant harm and the point at which such harm occurs. The report also made clear those indicators of significant harm for each of the three hydrologic systems. The report should, however, have made it clearer that MFLs are set to prevent the occurrence of significant harm. Results of the panels evaluation were presented in five major conclusions and 23 recommendations. The conclusions can be summarized as follows:

- The MFL criteria of 11 ft NGVD is appropriate given current information, however, long-term and cumulative effects of levels below 11 feet NGVD on the littoral zone of Lake Okeechobee are uncertain.
- The minimum canal level approach used to establish minimum water levels in the Biscayne aquifer has merit but does not directly address the issue.
- Use of hydric soils as an indicator of MFLs is appropriate, but the MFLs will need to be adapted to fit the diversity of soils present in the region.
- Special consideration should be given to areas with less than one foot of peat soil and less than 1.5 feet of marl soils.
- It is possible to set *initial* MFLs for the three hydrologic systems under consideration prior to setting MFLs for other areas such as Florida and Biscayne bays.

The recommendations addressed the issues raised in the conclusions in greater detail and provided suggestions to improve the final report. A copy of the final report of the peer review panel and responses of District staff to the report recommendations are provided in **Appendix D**.

Periodic Review of Minimum Flows and Levels

Minimum flows and levels, as well as all water resource protection standards, should be updated on a periodic basis to incorporate newly identified technical information and evolving water management district goals and objectives. For example, the Everglades minimum levels, as proposed, have been identified based on protecting the

restored system, as identified in the Restudy, from significant harm. The Comprehensive Everglades Restoration Plan will refine and adapt the recommendations made in the Restudy based on future research results, design changes, and technological advances. Restoration goals and harm standards may change as the system improves over time and in response to new laws and policies of the District's Governing Board and state and federal government. During the next 50 years the Everglades system will be managed to adapt to these conditions. As a part of this effort, minimum levels will also be reviewed on a periodic basis to determine whether the harm and significant harm standards are effectively protecting the resource and fulfilling the legal standards imposed by statute. It is the intent of the District to review the scientific basis of the proposed interim MFL criteria in all future updates of the *LEC Regional Water Supply Plan*. The plan will be updated approximately every five years.

PRELIMINARY ISSUES

The following preliminary issues must be addressed to establish a minimum flow or level for a specific area:

- What are the priority functions of each water resource and what is the baseline condition for the functions being protected?
- What level of protection for these functions is provided by various harm standards, set forth in Chapter 373, F.S., including *significant harm*?

The following discussion is provided to help understand the legal, policy, and technical implications of these issues in establishing minimum levels for Lake Okeechobee, the Biscayne aquifer, and the remaining Everglades ecosystem.

Water Resource Functions

Each surface water body or aquifer serves an array of functions. These functions must each be considered when establishing a minimum flow or level as a basis to determine whether or not the water resource is sustainable. The *State Comprehensive Plan*, Section 187.201(8)(b)6., F.S., provides that the water management districts shall do the following:

> Establish minimum seasonal flows and levels for surface watercourses with primary consideration given to the protection of natural resources, especially marine, estuarine, and aquatic ecosystems.

The term, water resource, is used throughout Chapter 373, and is part of the statute title. Water resource functions that are protected under Chapter 373 are broad, as illustrated in Section 373.016, F.S., which includes flood control, water quality protection, water supply and storage, fish and wildlife protection, navigation, and recreation. The need to protect water resources from harm is mentioned in many different places within the statute, including statutory intent (373.016), regulatory implementation (373.219,

373.414), water shortage implementation (373.175, 373.246), enforcement provisions (373.129), and planning requirements (373.026).

Water resources include aquatic and wetland, as well as the abiotic and biotic, components of these systems. The abiotic components include water, its chemical makeup, and soils. Biotic components include the plants and animals that comprise and depend on these systems. Many complex interactions exist among the water and living components that determine the essential nature of water resources.

The State Water Policy, Section 62-40.405, F.A.C, requires that consideration be given to protection of water resources. Consideration was given to natural seasonal changes in water flows or levels, environmental values associated with aquatic and wetland ecology, and water levels in aquifer systems. Specific considerations include the following:

- Fish and wildlife habitat and the passage of fish
- Maintenance of freshwater storage and supply
- Water quality
- Estuarine resources
- Transfer of detrital material
- Filtration and absorption of nutrients and pollutants
- Sediment loads
- Recreation in and on the water
- Navigation
- Aesthetic and scenic attributes

The ultimate policy determination as to which resource functions to consider in establishing MFLs is within the Governing Board's purview. This analysis requires a comprehensive look at sustainability of the resource itself, as well as it’s role in sustaining overall regional water resources.

Identification of Baseline Conditions for Water Resource Functions

Once the water resource functions to be protected by a specific minimum flow or level have been identified, these functions are then evaluated to determine their applicable baseline or desired condition. These considerations are set forth in Section 373.0421(1)(a), F.S. and allow water management districts, when setting MFLs, to consider changes and structural alterations that have occurred to a water resource. Likewise, Section 373.0421(1)(b), F.S., recognizes that certain water bodies no longer serve their historical function and that recovery of these water bodies to historical conditions may not be feasible. Allowances are provided to account for the loss of historical functions. These provisions are discussed in Chapter 2.

Level of Protection Provided by Various Harm Standards in Chapter 373

Definition and Basis of Harm

The overall purpose of Chapter 373 is to ensure the sustainability of water resources of the state (Section 373.016, F.S.) To carry out this responsibility, Chapter 373 provides the District with several tools, with varying levels of resource protection standards. MFLs play one part in this framework. Determination of the role of MFLs and the protection that they offer, versus other water resource tools available to the District, are discussed below.

The scope and context of MFLs protection rests with the definition of significant harm. The following discussion provides some context to the MFLs statute, including the significant harm standard, in relation to other water resource protection statutes.

Sustainability is the umbrella of water resource protection standards (Section 373.016, F.S.). Each water resource protection standard must fit into a statutory niche to achieve this overall goal. Pursuant to Parts II and IV of Chapter 373, surface water management and consumptive use permitting regulatory programs must prevent **harm** to the water resource. Whereas water shortage statutes dictate that permitted water supplies must be restricted from use to prevent **serious harm** to the water resources. Other protection tools include health and safety or reservation of water for fish and wildlife (Section 373.223(3)), and aquifer zoning to prevent undesirable uses of the ground water (Section 373.036). By contrast, MFLs are set at the point at which **significant harm** to the water resources, or ecology, would occur. The levels of harm cited above, harm, significant harm, and serious harm, are relative resource protection terms, each playing a role in the ultimate goal of achieving a sustainable water resource.

Need for Maximum Levels

Establishing *minimum* levels alone will not be sufficient to maintain a sustainable resource or protect it from significant harm. For both Lake Okeechobee and the Everglades, floods or extended periods of high water, also impact the resource. Setting minimum levels is viewed as a starting point to define water needs for sustainability. The necessary hydrologic regime for restoration of the entire Kissimmee-Lake Okeechobee-Everglades ecosystem must also be defined and implemented through the use of water reservations and other water resource protection tools. Achieving the required water levels throughout this system is an overall, long-term restoration goal. *Maximum* levels for Lake Okeechobee and the WCAs are controlled by regulation schedules for these areas. The overall ability of these schedules to protect the resource is uncertain due to the limited water storage capacity of the regional system, especially during above normal rainfall years. As a result, new or revised maximum water level criteria are being considered for certain areas as part of the Lower East Coast regional water supply planning process. These areas include WCA-3A, WCA-3B and WCA-2A, where existing tree islands require protection. The maximum water level for Lake Okeechobee, as determined by the

regulation schedule, is currently being reviewed by the USACE, the District, and other agencies.

Consumptive Use Permitting Role - Harm Standard

The resource protection criteria used for consumptive use permitting are based on the level of impact that is considered harmful to the water resource. These criteria are applied to varying resource functions, in order to establish the range of hydrologic change that can occur without harm. The hydrological criteria include level, duration, and frequency components and are used to define the amount of water that can be allocated from the resource. According to Chapter 40E-2, F.A.C., saltwater intrusion, wetland drawdown, aquifer mining, and pollution prevention criteria, all define the harm standard for purposes of consumptive use allocation. These harm criteria may be applied using climate conditions that represent an assumed level of certainty. The level of certainty used in the Lower West Coast and Upper East Coast water supply plans is a 1-in-10 year drought frequency, as defined in the District's permitting rules. In addition, the 1-in-10 year drought level of certainty is the water supply planning goal that was established in the 1997 legislative changes (Section 373.0831, F.S.). Another possible standard for harm may be the inability to achieve long-term planning or restoration goals. The standard for harm, as used in the Consumptive Use Permitting process, is considered to be the point at which adverse impacts to water resources that occur during dry conditions are sufficiently severe that they cannot be restored within a period of one to two years of average rainfall conditions. These short-term adverse impacts are addressed under the consumptive use permit program, which calculates allocations to meet demands for use during relatively mild, dry season conditions.

Water Shortage Role - Serious Harm Standard

Pursuant to Section 373.246, F.S., water shortage declarations are designed to prevent serious harm from occurring to water resources. Serious harm, the ultimate harm to the water resources that was contemplated under Chapter 373, F.S., can be interpreted as long-term, irreversible, or permanent impacts. Declaration of water shortages is another tool that may be used by the Governing Board to prevent serious harm.

When drought conditions exist, water users, typically for irrigation or outside use, increase the amount of withdrawals to supplement water not provided by rainfall. In general, the more severe the drought, the more supplemental water is needed, which increases water shortage restrictions for users. These increased withdrawals increase the potential for serious harm to the water resource.

Comparison of Significant Harm to Harm and Serious Harm Standards

Where does the significant harm standard lie in comparison to the consumptive use permitting and water shortage standards? The plain language of the standards of harm versus significant harm, although undefined by statute, implies that the minimum flow or level criteria should consider impacts that are more severe than those addressed by the consumptive use permitting harm standard, but less severe than the impacts addressed by

the serious harm water shortage standard. The conceptual relationship among the terms harm, significant harm, and serious harm are shown in **Figure 1**.

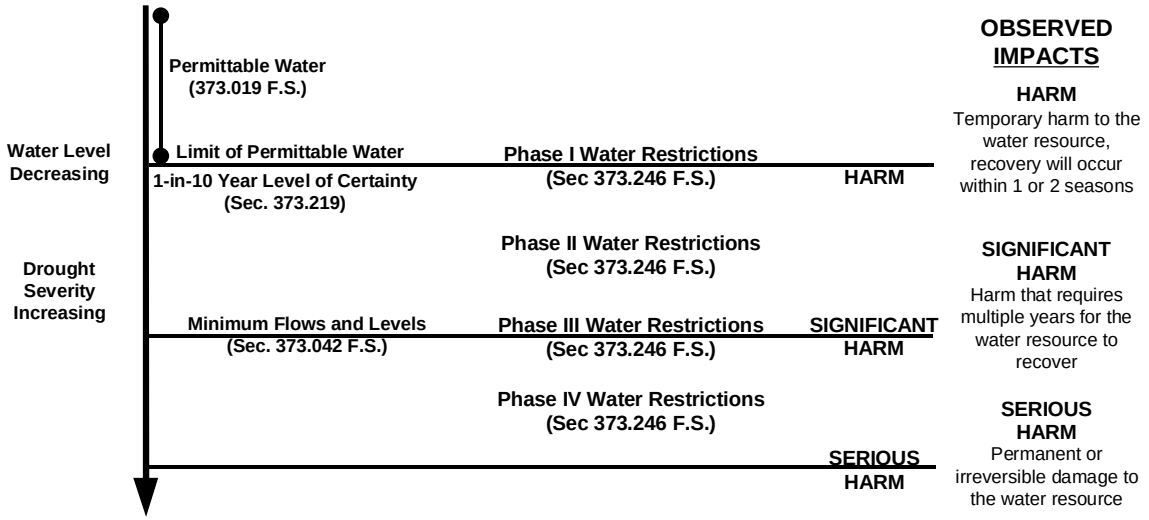

Figure 1. Conceptual Relationship Among the Terms Harm, Significant Harm, and Serious Harm.

The technical discussions in Chapter 4 of this report only identify the scale of water resource impacts associated with significant harm that are required to establish minimum water levels for the Everglades, Biscayne aquifer, and Lake Okeechobee. As noted at the beginning of this chapter, conflicts may arise between these MFL criteria and the restoration goals for the Everglades which are presently being refined and developed in the Comprehensive Everglades Restoration Plan. As restoration goals for particular areas change over time, proposed MFLs may also be adjusted, to ensure some degree of consistency with the model described in **Figure 1**.

The District has implemented its water shortage authority by restricting consumptive uses based on the concept of shared adversity between users and the water resources (Chapter 40E-21, F.A.C.). Under this program, different levels or phases of water shortage restrictions are imposed relative to the severity of drought conditions.

Four phases of the current water shortage restrictions are based on the relative levels of risk posed to resource conditions leading up to the serious harm impacts. Under the SFWMD's program, Phase I and II water shortages are primarily designed to prevent harm, such as localized, but recoverable, damage to wetlands or short-term inability to maintain water levels needed for restoration. Actions that may be taken include reducing water use through conservation techniques and minor use restrictions, such as car washing and lawn watering. Phases III and IV, however, require use cutbacks which are associated with some level of economic impact to the users, such as agricultural irrigation restrictions.

The exact actions taken to implement MFLs will be laid out in a recovery and prevention strategy developed through regional water supply planning. Whether a minimum flow or level will be used as a permitting standard or water shortage trigger will depend on whether, and to what extent, the existing permitted uses are causing exceedances and under which level of drought this occurs (e.g., a drought equal or less in severity than the level of certainty or one which is more severe and more appropriately addressed through water shortage cutbacks). In any case, some level of buffer between the MFL and permitting levels must be achieved in order to prevent continuous violations.

Proposed Definition of Significant Harm to Water Resources

Based on the above considerations, the definition of significant harm for the water resources of an area, as proposed in this document is as follows:

Significant harm *is defined as a loss of specific water resource functions that take multiple years to recover, which result from a change in surface water or ground water hydrology.*

MINIMUM FLOW AND LEVELS RECOVERY AND PREVENTION STRATEGY

Section 373.0421, F.S. requires that once the MFL technical criteria have been established, the districts must develop a recovery and prevention strategy for those water bodies that are expected to exceed the proposed criteria. It is possible that the proposed MFL criteria cannot be achieved immediately because of ineffective water distribution infrastructure and/or the lack of adequate regional storage. These storage and infrastructure shortfalls will be resolved through water resource development and water supply development projects, construction of facilities, and improved operational strategies that will increase the region's storage capacity and improve the existing delivery system. Planning and regulatory efforts will, therefore, include a programmed recovery process that will be implemented over time to improve water supply and distribution to protect water resources and functions.

Development of the *Minimum Flows and Levels Recovery And Prevention Plan for Lake Okeechobee, the Everglades and the Biscayne Aquifer* is underway and will be incorporated into the LEC regional water supply planning process. Appropriate technical analysis are also being conducted to determine the water supply implications of the proposed MFL Technical Criteria on urban and agricultural users. These results will be integrated into the final *LEC Regional Water Supply Plan* analysis with appropriate implementation measures developed consistent with Section 373.0421 F.S.

DOCUMENT STRUCTURE

The following chapter of this report describes the geographic setting, the resources at risk, and functions these resources serve that need to be protected, for Lake Okeechobee, the Everglades, and the Biscayne aquifer. Chapter 3 documents the methods that were used to establish significant harm criteria for the different areas, resources, and functions. Chapter 4 describes the specific hydrologic criteria, with frequency, duration, and depth components, that were developed to indicate the point at which significant harm occurs and includes an analysis of the specific relevant factors and implications of the proposed definition of significant harm. Conclusions and recommendations are presented in Chapter 5 and the literature cited is in the final chapter. Technical Appendices A through F are provided in a separate volume and include more detailed descriptions and analysis of available data, literature, and issues raised during the review process.